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(54) **COMPOSITION CONTAINING  
ANTI-MISTING COMPONENT**

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(57) **ABSTRACT**

The invention relates to coating formulations comprising (i) a silicone-based coating component susceptible to misting under mist-producing conditions; and (ii) an anti-misting amount of a branched polysiloxane component resulting from copolymerizing under hydrosilylation conditions a component mixture comprising (a) one or more organosilicon compounds containing at least two unsaturated hydrocarbon functional groups per molecule, and (b) one or more silylhydride-containing compounds containing at least two silylhydride functional groups per molecule, with the provision that (i) at least one component (a) or (b) contains at least three functional groups per molecule; (ii) a component (a) or (b) having a higher number of functional groups per molecule is present in a molar amount equal to or lower than a molar amount of the other component (a) or (b) having a lower number of functional groups per molecule; and (iii) unsaturated hydrocarbon compounds are excluded from the component mixture. The invention also relates to a process for coating a substrate with the above coating formulation, as well as hardened silicone-based coatings or films obtained by subjecting the coated substrate to one or more curing steps.

**29 Claims, No Drawings**



## 1

**COMPOSITION CONTAINING  
ANTI-MISTING COMPONENT****BACKGROUND OF THE INVENTION**

## 1. Field of the Invention

The invention relates to compositions containing mist suppressant compositions and their particular use in coating processes where a reduced level of misting or aerosoling is desired.

## 2. Description of the Prior Art

It is well known that in operations where silicone-based paper release coating formulations are subjected to a high enough rotational or translational motion, e.g., in high speed roll coating of flexible supports and paper, misting and/or aerosoling can become significant problems. These problems become particularly significant when applying these release coatings at roll coating speeds approaching 1000 ft/min, while the trend in the paper coating industry is to use speeds in excess of 1500 ft/min, e.g., 2000-3000 ft/min. In addition to having a deleterious effect on manufacturing operations, these mist and aerosol particles present industrial hygiene and safety issues for those people operating or working in the vicinity of the coating equipment.

Specialized chemical formulations known generically as "mist suppressants" have commonly been used to reduce the formation of mist in such operations. For example, U.S. Pat. Nos. 6,805,914 and 6,489,407 (hereinafter the '914 and '407 patents) disclose silicone mist suppressant compositions derived from reacting an excess of at least one organohydrogensilicone compound containing at least three silicon-bonded hydrogen groups per molecule (component (a)) with at least one compound containing at least two alkenyl groups per molecule (component (b)), wherein the ratio of the number of silicon-bonded hydrogen atoms of component (a) to the number of alkenyl groups of component (b) is at least 4.6:1, and more preferably from 4.6:1 to 500:1.

U.S. Pat. No. 6,586,535 discloses essentially the inverse of the '914 and '407 patents, i.e., silicone mist suppressant compositions derived from reacting at least one organohydrogensilicon compound containing at least two silicon-bonded hydrogen groups with an excess of at least one organoalkenylsiloxane compound containing at least three silicon-bonded alkenyl groups, wherein the ratio of the number of silicon-bonded hydrogen atoms of component (a) to the number of alkenyl groups of component (b) is less than or equal to 1:4.6, and preferably from 1:4.6 to 1:500.

U.S. Pat. Nos. 6,764,717 and 6,956,096 disclose silicone-based mist suppressant compositions derived from a two-step process involving: (a) reacting a hydrocarbon containing at least three aliphatic double bonds with a stoichiometric excess of organosiloxane compounds having terminal silicon-bonded hydrogen atoms, wherein the ratio of silicon-bonded hydrogen to aliphatic double bonds is from 1.3 to 10, and preferably from 1.5 to 5; and (b) reacting the resulting hydrocarbon-siloxane copolymers, which contain silicon-bonded hydrogen atoms, with a stoichiometric excess of  $\alpha,\omega$ -dialkenylsiloxane polymer, wherein the ratio of aliphatic double bonds in the  $\alpha,\omega$ -dialkenylsiloxane polymer to silicon-bonded hydrogen in the hydrocarbon-siloxane copolymer obtained in the first step is from 1.2 to 10, preferably from 1.5 to 5.0.

U.S. Pat. Nos. 6,887,949, 6,774,201, and 6,727,338 disclose silicone polymers as anti-mist additives wherein unsaturated hydrocarbon compounds are included in the synthesis of the silicone polymers.

## 2

U.S. Pat. No. 5,625,023 discloses mist suppressant compositions derived by reacting an organosilicon compound, an oxyalkylene-containing compound, and a catalyst.

U.S. Pat. No. 5,399,614 discloses adhesive compositions containing alkenyl-terminated polydiorganosiloxanes and silylhydride-terminated organohydrogenpolysiloxanes.

However, there remains a need for coating compositions, particularly paper release compositions, having a reduced level of misting when used in mist-producing processes, particularly in high-speed coating processes, while providing other benefits, such as cost savings, ease of production, and ease of use.

**BRIEF DESCRIPTION OF THE INVENTION**

These and other objectives have been achieved, firstly, by providing a composition (i.e. coating formulation) comprising:

- (i) a silicone-based coating component susceptible to misting under mist-producing conditions; and
- (ii) an anti-misting amount of a branched polysiloxane component resulting from copolymerizing under hydrosilylation conditions a component mixture comprising:
  - (a) one or more organosilicon compounds containing at least two unsaturated hydrocarbon functional groups per molecule, said unsaturated hydrocarbon functional groups capable of undergoing a hydrosilylation reaction with a silylhydride-containing compound under hydrosilylation conditions; and
  - (b) one or more silylhydride-containing compounds containing at least two silylhydride functional groups per molecule;

provided that (i) at least one component (a) or (b) contains at least three functional groups per molecule; (ii) when one component (a) or (b) has a higher number of functional groups per molecule than another component (a) or (b) having a lower number of functional groups per molecule, then the component (a) or (b) having a higher number of functional groups per molecule is present in a molar amount equal to or lower than the molar amount of the component (a) or (b) having a lower number of functional groups per molecule; and (iii) unsaturated hydrocarbon compounds are excluded from the component mixture.

In one embodiment, the unsaturated hydrocarbon functional groups of component (a) are in a molar ratio to silylhydride functional groups of component (b) within a range according to a formula  $(6-s):1$  or  $1:(1+t)$  where  $s$  represents a number equal to or greater than 0 and less than 5, and  $t$  represents a number greater than 0 and equal to or less than 5.

In another embodiment, the unsaturated hydrocarbon functional groups of component (a) are in a molar ratio to silylhydride functional groups of component (b) within a range according to a formula  $(4.6-s):1$  or  $1:(1+s)$  where  $s$  represents a number greater than 0 and less than 3.6.

In another embodiment, the unsaturated hydrocarbon functional groups of component (a) are in a molar ratio to silylhydride functional groups of component (b) within a range according to a formula  $(4.25-s):1$  or  $1:(1+t)$  where  $s$  represents a number equal to or greater than 0 and less than 3.25, and  $t$  represents a number greater than 0 and equal to or less than 3.25.

In yet another embodiment, the unsaturated hydrocarbon functional groups of component (a) are in a molar ratio to silylhydride functional groups of component (b) within a range of about 4.5:1 to about 2:1.



## 3

In particular embodiments, one component (a) or (b) has at least four, or at least six, or at least eight, or a higher number of functional groups per molecule, and is in a lower molar amount than the other component (a) or (b) having two or three functional groups per molecule.

The invention is also directed to a coating process comprising applying to a substrate under mist-producing conditions the coating formulations described above. The coating formulation exhibits reduced misting when subjected to these mist-producing conditions as compared to the same composition lacking the anti-misting amount of branched polysiloxane component.

The invention is also directed to a hardened silicone-based coating or film produced by subjecting a substrate coated with the coating formulations, as described above, to one or more curing steps.

The present invention advantageously provides paper release, adhesive, and related coating compositions containing novel branched polysiloxane mist suppressants. The compositions containing these mist suppressants are capable of significant reductions in misting during high speed coating operations while affording the additional benefits of being economical and simple to use and make.

## DETAILED DESCRIPTION OF THE INVENTION

The compositions of the invention contain, minimally, two components: (i) a silicone-based coating component susceptible to misting under mist-producing conditions; and (ii) an anti-misting amount of a branched polysiloxane component (the anti-misting component).

The silicone-based coating component must be of such a flowable consistency that it can be applied to a substrate as a coating, e.g., by roll-coating, spraying, and the like. For example, the silicone-based coating component can be an uncured or partially cured liquid having a viscosity low enough so that it can be readily applied as a coating on a substrate. Typically, the silicone-based coating component has a viscosity below 1,500 centipoise (cPs), more typically in the range 50 to 1,000 cPs, and even more typically in the range 50 to 500 cPs, where 1 centipoise (cPs)=1 millipascal-second (mPa·s).

The silicone-based coating component can be directed to any application for which a silicone-based coating is useful, e.g., as release agents, lubricants, protectants, adhesives, and so on. A particularly suitable type of silicone-based coating component includes the well-known class of pressure-sensitive adhesives, which have the property of adhering to a surface and being easily removed therefrom without transferring more than trace quantities of the adhesive to the substrate surface.

For example, the silicone-based coating component can be any of the curable silicone coating or paper release compositions known in the art. Some examples of classes of curable silicone coating compositions are those which are curable by hydrosilylation reaction crosslinking, peroxide curing, photocuring (e.g., UV curing), and electron beam curing.

In one embodiment, the silicone-based coating component includes components capable of crosslinking under hydrosilylation reaction conditions, e.g., in the presence of a hydrosilylation catalyst, as further discussed below. The components capable of crosslinking under hydrosilylation reaction conditions include (i) one or more organosilicon compounds containing at least two unsaturated hydrocarbon functional groups per molecule, and (ii) one or more silylhydride-containing compounds containing at least two silylhydride functional groups per molecule. Some examples of unsaturated

## 4

hydrocarbon groups of component (i) include vinyl, allyl, 3-butenyl, 4-pentenyl, 5-hexenyl, 6-heptenyl, 7-octenyl, 8-nonyl, 9-decenyl, 10-undecenyl, 4,7-octadienyl, 5,8-nonadienyl, and the like.

The unsaturated organosilicon compound of component (i) and the silylhydride-containing compound of component (ii) can be, independently, for example, a low molecular weight silane, disilane, trisilane, siloxane, disiloxane, trisiloxane, cyclotrisiloxane, or cyclotetrasiloxane compound, or the like, having either: at least two unsaturated hydrocarbon groups for the case of component (i), or at least two silylhydride functional groups for the case of component (ii). The examples given later on in this specification for each of these types of compounds for the anti-misting component apply here as well.

Alternatively, components (i) and/or (ii) can be any of the linear, branched, and/or crosslinked polymers having any two or more of a combination of M, D, T, and Q groups, wherein, as known in the art, an M group represents a monofunctional group of formula  $R_3SiO_{1/2}$ , a D group represents a bifunctional group of formula  $R_2SiO_{2/2}$ , a T group represents a trifunctional group of formula  $RSiO_{3/2}$ , and a Q group represents a tetrafunctional group of formula  $SiO_{4/2}$ , wherein the R groups can be any suitable groups including hydrogen, hydrocarbon (e.g.,  $C_1-C_6$ ), halogen, alkoxy, and/or amino groups, and wherein at least two of the R groups in the siloxanes described above are either: at least two unsaturated hydrocarbon groups for the case of component (i), or at least two silylhydride functional groups for the case of component (ii). Some examples of classes of polysiloxanes suitable for the silicone-based coating components include the MDM, TD, MT, MDT, MDTQ, MQ, MDQ, and MTQ classes of polysiloxanes, and combinations thereof, having either: at least two unsaturated hydrocarbon groups for the case of component (i), or at least two silylhydride functional groups for the case of component (ii).

For example, the silicone-based coating component can be a standard silicone paper release formulation containing 90-99% by weight of a vinylated polydimethylsiloxane polymer and 1-10% by weight of a silylhydride-functionalized siloxane-based compound or polymer based on the total weight of the silicone-based coating component, wherein each of the vinyl-containing and silylhydride-containing components typically has a viscosity in the range of about 20-500 cPs.

Typically, a catalyst inhibitor is included in the coating formulation in order to prevent curing of the catalyst during processing or to extend bath life or stability to the formulation during storage. The catalyst inhibitor can be any chemical known in the art which can inhibit the catalyst from curing during the coating process while not preventing curing when curing is desired. For example, the catalyst inhibitor can be a chemical which will sufficiently inhibit the catalyst from curing at room temperature during application of the coating formulation, but loses its inhibitory effect on being subjected to elevated temperatures when cure is desired. The inhibitor is typically included in the composition in an amount of about 5 to about 15 parts by weight of the composition. Some examples of catalyst inhibitors include maleates, fumarates, unsaturated amides, acetylenic compounds, unsaturated isocyanines, unsaturated hydrocarbon diesters, hydroperoxides, nitrites, and diaziridines.

The anti-misting component (i.e., the branched polysiloxane component) is included in the composition of the invention (i.e., the coating formulation) in an anti-misting amount. An anti-misting amount (mist suppressant amount), is an amount which causes a reduction in misting or aerosoling



## 5

when the composition of the invention is used in a process which ordinarily causes misting or aerosoling of the composition. Typically, the anti-misting component is included in the coating formulation in an amount of about 0.1 to about 15 weight percent, and more typically, about 0.5 to about 5 weight percent of the coating formulation.

The antimisting component results from copolymerizing, under hydrosilylation reaction conditions, one or more organosilicon compounds containing at least two unsaturated hydrocarbon functional groups per molecule, i.e., component (a), with one or more silylhydride-containing compounds containing at least two silylhydride functional groups per molecule, i.e., component (b).

The organosilicon compound of component (a) includes any low molecular weight compound, as well as higher molecular weight oligomers and polymers, containing one or more silicon atoms and having at least two unsaturated hydrocarbon functional groups. Some examples of classes of organosilicon compounds of component (a) include organosilanes (i.e., containing silicon-carbon bonds in the absence of silicon-oxy bonds), siloxanes, and silazanes containing at least two unsaturated hydrocarbon groups.

The unsaturated hydrocarbon groups in the organosilicon compounds of component (a) include any straight-chained, branched, or cyclic hydrocarbon groups having at least one carbon-carbon double or triple bond capable of reacting with a silylhydride group under hydrosilylation conditions. More typically, the unsaturated hydrocarbon group contains two to six carbon atoms. Some examples of unsaturated hydrocarbon groups include substituted and unsubstituted vinyl, allyl, butenyl, butadienyl, 4-pentenyl, 2,4-pentadienyl, 5-hexenyl, cyclobutenyl, cyclohexenyl, acryloyl, and methacryloyl.

Some examples of low molecular weight organosilane compounds of component (a) include divinyl dimethylsilane, divinyl dichlorosilane, divinyl methylpropylsilane, divinyl dipropylsilane, divinyl diisopropylsilane, divinyl diphenylsilane, divinyl phenylpropylsilane, trivinyl methylsilane, trivinyl ethoxysilane, trivinyl chlorosilane, trivinyl phenylsilane, diallyl dimethylsilane, diallyl dichlorosilane, allyl vinyl dimethylsilane, trivinyl phenylsilane, 1,3-divinyl tetramethyl disilylmethane, 1,4-divinyl tetramethyl disilylethane, 1,1-divinyl tetramethyl disilylethane, 1,1,4-trivinyl trimethyl disilylethane, 1,1,1-trivinyl trimethyl disilylethane, 1,1,4,4-tetravinyl dimethyl disilylethane, 1,1,1,4-tetravinyl dimethyl disilylethane, 1,1,1,4,4,4-hexavinyl disilylethane, 1,3-divinyl tetraphenyl disilylmethane, 1,4-divinyl tetraphenyl disilylethane, 1,1-divinyl tetraphenyl disilylethane, 1,1,4-trivinyl triphenyl disilylethane, 1,1,1-trivinyl triphenyl disilylethane, 1,1,4,4-tetravinyl diphenyl disilylethane, and 1,1,1,4-tetravinyl diphenyl disilylethane.

Some examples of low molecular weight siloxane compounds of component (a) include divinyl dimethoxysilane, divinyl diethoxysilane, trivinyl ethoxysilane, diallyl diethoxysilane, triallyl ethoxysilane, vinyl dimethyl siloxy vinyl dimethyl carbinol  $(\text{CH}_2=\text{CH}_2-\text{C}(\text{CH}_3)_2-\text{O}-\text{Si}(\text{CH}_3)_2(\text{CH}_2=\text{CH}_2))$ , 1,3-divinyl tetramethyl disiloxane, 1,3-divinyl tetraethyl disiloxane, 1,1-divinyl tetramethyl disiloxane, 1,1,3-trivinyl trimethyl disiloxane, 1,1,1-trivinyl trimethyl disiloxane, 1,1,3,3-tetravinyl dimethyl disiloxane, 1,1,1,3-tetravinyl dimethyl disiloxane, 1,3-divinyl tetraphenyl disiloxane, 1,1,3-divinyl tetraphenyl disiloxane, 1,1,1,3-tetravinyl diphenyl disiloxane, hexavinyl disiloxane, tris(vinyl dimethyl siloxy) methylsilane, tris(vinyl dimethyl siloxy) methoxysilane, tris(vinyl dimethyl siloxy) phenylsilane, and tetrakis(vinyl dimethyl siloxy) silane.

## 6

Some examples of linear siloxane oligomers of component (a) include 1,5-divinyl hexamethyl trisiloxane, 1,3-divinyl hexamethyl trisiloxane, 1,1-divinyl hexamethyl trisiloxane, 3,3-divinyl hexamethyl trisiloxane, 1,5-divinyl hexaphenyl trisiloxane, 1,3-divinyl hexaphenyl trisiloxane, 1,1-divinyl hexaphenyl trisiloxane, 3,3-divinyl hexaphenyl trisiloxane, 1,1,1-trivinyl pentamethyl trisiloxane, 1,3,5-trivinyl pentamethyl trisiloxane, 1,1,1-trivinyl pentaphenyl trisiloxane, 1,3,5-trivinyl pentaphenyl trisiloxane, 1,1,3,3-tetravinyl tetramethyl trisiloxane, 1,1,5,5-tetravinyl tetramethyl trisiloxane, 1,1,3,3-tetravinyl tetraphenyl trisiloxane, 1,1,5,5-tetravinyl tetraphenyl trisiloxane, 1,1,1,3,3-pentavinyl trimethyl trisiloxane, 1,1,3,5,5-pentavinyl trimethyl trisiloxane, 1,1,3,3,5,5-hexavinyl dimethyl trisiloxane, 1,1,1,5,5,5-hexavinyl dimethyl trisiloxane, 1,1,1,5,5,5-hexavinyl diphenyl trisiloxane, 1,1,1,5,5,5-hexavinyl dimethoxy trisiloxane, 1,7-divinyl octamethyl tetrasiloxane, 1,3,5,7-tetravinyl hexamethyl tetrasiloxane, and 1,1,7,7-tetravinyl hexamethyl tetrasiloxane.

Some examples of cyclic siloxane oligomers of component (a) include 1,3-divinyl tetramethyl cyclotrisiloxane, 1,3,5-trivinyl trimethyl cyclotrisiloxane, 1,3-divinyl tetraphenyl cyclotrisiloxane, 1,3,5-trivinyl triphenyl cyclotrisiloxane, 1,3-divinyl hexamethyl cyclotetrasiloxane, 1,3,5-trivinyl pentamethyl cyclotetrasiloxane, and 1,3,5,7-tetravinyl tetramethyl cyclotetrasiloxane.

Some examples of silazanes of component (a) include 1,3-divinyl tetramethyl disilazane, 1,3-divinyl-1,3-diphenyl-1,3-dimethyl disilazane, 1,3,5-trivinyl trimethyl cyclotrisilazane, 1,3,5-trivinyl triphenyl cyclotrisilazane, 1,3,5-trivinyl pentamethyl cyclotetrasilazane, and 1,3,5,7-tetravinyl tetramethyl cyclotetrasilazane.

The polymeric siloxanes (polysiloxanes) of component (a) include any of the linear, branched, and/or crosslinked polymers having any two or more of a combination of M, D, T, and Q groups, wherein, as known in the art, an M group represents a monofunctional group of formula  $\text{R}_3\text{SiO}_{1/2}$ , a D group represents a bifunctional group of formula  $\text{R}_2\text{SiO}_{2/2}$ , a T group represents a trifunctional group of formula  $\text{RSiO}_{3/2}$ , and a Q group represents a tetrafunctional group of formula  $\text{SiO}_{4/2}$ , and wherein at least two of the R groups are unsaturated hydrocarbon groups and the remainder of the R groups can be any suitable groups including hydrocarbon (e.g.,  $\text{C}_1-\text{C}_6$ ), halogen, alkoxy, and/or amino groups.

Some examples of classes of polysiloxanes suitable for component (a) include the MDM, TD, MT, MDT, MDTQ, MQ, MDQ, and MTQ classes of polysiloxanes, and combinations thereof, having at least two unsaturated hydrocarbon groups.

In a particular embodiment, component (a) is an MD-type of polysiloxane having one or more M and/or  $\text{M}^{\text{vi}}$  groups in combination with one or more D and/or  $\text{D}^{\text{vi}}$  groups, wherein M represents  $\text{Si}(\text{CH}_3)_3\text{O}-$ ,  $\text{M}^{\text{vi}}$  represents  $(\text{CH}_2=\text{CH}_2)\text{Si}(\text{CH}_3)_2\text{O}-$ , D represents  $-\text{Si}(\text{CH}_3)_2\text{O}-$ , and  $\text{D}^{\text{vi}}$  represents



—Si(CH<sub>2</sub>=CH<sub>2</sub>)(CH<sub>3</sub>)O—, “vi” is an abbreviation for “vinyl,” and wherein the MD-type of polysiloxane contains at least two vinyl groups.

Some examples of suitable MD-type polysiloxanes for component (a) include the M<sup>vi</sup>D<sub>n</sub>M<sup>vi</sup>, M<sup>vi</sup>D<sup>vi</sup><sub>n</sub>M, M<sup>vi</sup>D<sup>vi</sup><sub>n</sub>—D<sub>m</sub>M, M<sup>vi</sup>D<sup>vi</sup><sub>n</sub>M<sup>vi</sup>, M<sup>vi</sup>D<sup>vi</sup><sub>n</sub>D<sub>m</sub>M<sup>vi</sup>, MD<sup>vi</sup><sub>n</sub>M, and MD<sup>vi</sup><sub>n</sub>D<sub>m</sub>M classes of MD-type polysiloxanes, wherein m and n each represent at least 1. Any one or combination of the foregoing types of MD polysiloxanes can be used for component (a). In various embodiments, m and n can independently represent, for example, a number within the ranges 1-10, 11-20, 50-100, 101-200, 201-500, 501-1500, and higher numbers.

The D<sup>vi</sup> groups can also be randomly incorporated (i.e., not as a block) amongst D groups. For example, M<sup>vi</sup>D<sup>vi</sup><sub>n</sub>D<sub>m</sub>M can represent a polymer wherein n represents 5-20 and m represents 50-1500, and wherein the 5-20 D<sup>vi</sup> groups are randomly incorporated amongst the 50-1500 D groups.

In other embodiments, the M<sup>vi</sup> and D<sup>vi</sup> groups can each independently include a higher number of unsaturated functional groups, such as, for example, (CH<sub>2</sub>=CH<sub>2</sub>)<sub>2</sub>(CH<sub>3</sub>)SiO— and (CH<sub>2</sub>=CH<sub>2</sub>)<sub>3</sub>SiO— groups for M<sup>vi</sup> or —Si(CH<sub>2</sub>=CH<sub>2</sub>)<sub>2</sub>O— for D<sup>vi</sup>.

The one or more silylhydride-containing compounds of component (b) includes any low molecular weight compound, oligomer, or polymer containing at least two silylhydride functional groups per molecule. Some examples of classes of silylhydride-containing compounds of component (b) include organosilanes, siloxanes, and silazanes containing at least two silylhydride functional groups.

Some examples of low molecular weight compounds of component (b) include dimethylsilane, diethylsilane, di-(n-propyl)silane, diisopropylsilane, diphenylsilane, methylchlorosilane, dichlorosilane, 1,3-disilapropane, 1,3-disilabutane, 1,4-disilabutane, 1,3-disilapentane, 1,4-disilapentane, 1,5-disilapentane, 1,6-disilahexane, bis-1,2-(dimethylsilyl)ethane, bis-1,3-(dimethylsilyl)propane, 1,2,3-trisilylpropane, 1,4-disilylbenzene, 1,2-dimethyldisilane, 1,1,2,2-tetramethyldisilane, 1,2-diphenyldisilane, 1,1,2,2-tetraphenyldisilane, 1,1,3,3-tetramethyldisiloxane, 1,1,3,3-tetraphenyldisiloxane, 1,1,3,3,5,5-hexamethyltrisiloxane, 1,1,1,5,5,5-hexamethyltrisiloxane, 1,3,5-trimethylcyclotrisiloxane, 1,3,5,7-tetramethylcyclotetrasiloxane, and 1,3,5,7-tetraphenylcyclotetrasiloxane.

Some examples of silylhydride-containing silazanes of component (b) include 1,1,3,3-tetramethyldisilazane, 1,3,5-triethyl-2,4,6-trimethylcyclotrisilazane, 1,2,3,4,5,6-hexamethylcyclotrisilazane, and 1,2,3,4,5,6,7,8-octamethylcyclotetrasilazane.

Some examples of silylhydride-containing oligomers and polymers of component (b) include any of the linear, branched, and/or crosslinked polymers having any two or more of a combination of M, D, T, and Q groups, as described above, and having at least two silylhydride functional groups in the oligomer or polymer.

In a particular embodiment, component (b) is an MD-type of polysiloxane having one or more M and/or M<sup>H</sup> groups in combination with one or more D and/or D<sup>H</sup> groups, wherein M represents Si(CH<sub>3</sub>)<sub>3</sub>O—, M<sup>H</sup> represents HSi(CH<sub>3</sub>)<sub>2</sub>O—, D represents —Si(CH<sub>3</sub>)<sub>2</sub>O—, and D<sup>H</sup> represents —Si(H)(CH<sub>3</sub>)O—, and wherein the MD-type of polysiloxane contains at least two silylhydride groups.

Some examples of suitable MD-type polysiloxanes for component (b) include the M<sup>H</sup>D<sub>n</sub>M<sup>H</sup>, M<sup>H</sup>D<sup>H</sup><sub>n</sub>M, M<sup>H</sup>D<sup>H</sup><sub>n</sub>D<sub>m</sub>M, M<sup>H</sup>D<sup>H</sup><sub>n</sub>M<sup>H</sup>, M<sup>H</sup>D<sup>H</sup><sub>n</sub>D<sub>m</sub>M<sup>H</sup>, MD<sup>H</sup><sub>n</sub>M, and MD<sup>H</sup><sub>n</sub>D<sub>m</sub>M classes of MD-type polysiloxanes, and combinations thereof, wherein m and n each represent at least 1 and can have any of the numerical values as described above.

The D<sup>H</sup> groups can also be randomly incorporated (i.e., not as a block) amongst D groups. For example, M<sup>H</sup>D<sup>H</sup><sub>n</sub>D<sub>m</sub>M can represent a polymer wherein n represents 5-20 and m represents 50-1500, and wherein the 5-20 D<sup>H</sup> groups are randomly incorporated amongst the 50-1500 D groups.

In other embodiments, M<sup>H</sup> and D<sup>H</sup> groups can independently have a higher number of silylhydride functional groups, such as, for example, H<sub>2</sub>Si(CH<sub>3</sub>)O— and H<sub>3</sub>SiO— groups for M<sup>H</sup> or —Si(H)<sub>2</sub>O— for D<sup>H</sup>.

According to the invention, at least one component (a) or (b) contains at least three functional groups per molecule. For example, one of component (a) or (b) can have three functional groups per molecule while the other component (a) or (b) contains two functional groups per molecule; or both component (a) and (b) can each contain three functional groups per molecule; or one of component (a) or (b) can have three functional groups per molecule while the other component (a) or (b) contains four functional groups per molecule; or both component (a) and (b) can each contain four functional groups per molecule; and so on.

In one embodiment, components (a) and (b) contain an equal number of functional groups and are in any molar ratio with respect to each other, including equal or similar molar amounts. In another embodiment, one of component (a) or (b) contains a higher number of functional groups than the other component (a) or (b) and both components are in equal molar amounts.

In another embodiment, the branched polysiloxane follows a branching pattern similar to a star polymer wherein molecules of either component (a) or (b) having a higher number of functional groups (i.e., crosslinkers) are in a lower molar amount than molecules of either component (a) or (b) having a lower number of functional groups (i.e., extenders). The above-described star polymer pattern is distinct from a dendritic pattern in which branching predominates.

For example, one component (a) or (b) can have at least four, five, six, seven, eight, nine, ten, or a higher number of functional groups and be in a lower molar amount than another component (a) or (b) containing two or three functional groups per molecule.

The unsaturated hydrocarbon functional groups of component (a) can be in any suitable molar ratio to silylhydride functional groups of component (b), e.g., 100:1, 50:1, 25:1, 20:1, 10:1, 1:10, 1:20, 1:25, 1:50, 1:100, and any range of ratios therebetween.

In a particular embodiment, the unsaturated hydrocarbon functional groups of component (a) are in a molar ratio to silylhydride functional groups of component (b) within a range according to the formula (6-s):1 or 1:(1+t) wherein s represents a number equal to or greater than 0 and less than 5, and t represents a number greater than 0 and equal to or less than 5. Some examples of such molar ratios of functional groups of (a) to functional groups of (b) include 6:1, 5.5:1, 5:1, 4.5:1, 4:1, 3.5:1, 3:1, 2.5:1, 2:1, 1.5:1, 1.4:1, 1.2:1, 1:1.2, 1:1.4, 1:1.5, 1:2, 1:2.5, 1:3, 1:3.5, 1:4, 1:4.5, 1:5, 1:5.5, and 1:6, and any range of ratios therebetween.

For example, in one embodiment, the unsaturated hydrocarbon functional groups of component (a) are in a molar ratio to silylhydride functional groups of component (b) within a range according to the formula (4.6-s):1 or 1:(1+s) wherein s represents a number greater than 0 and less than 3.6. In another embodiment, the unsaturated hydrocarbon functional groups of component (a) are in a molar ratio to silylhydride functional groups of component (b) within a range according to the formula (4.25-s):1 or 1:(1+t) wherein s represents a number equal to or greater than 0 and less than 3.25, and t represents a number greater than 0 and equal to or less than



3.25. In yet another embodiment, the unsaturated hydrocarbon functional groups of component (a) are in a molar ratio to silylhydride functional groups of component (b) within a range of about 4.5:1 to about 2:1.

The viscosity of the branched polysiloxane is typically greater than 1,500 centipoise (cPs), where 1 cPs=1 millipascal-second (mPa·s). More typically, the viscosity of the branched polysiloxane is about or greater than 3,000 cPs, and even more typically about 5,000 cPs. In other embodiments, the viscosity of the branched polysiloxane can be about or greater than 10,000 cPs, 25,000 cPs, 50,000 cPs, or a higher viscosity.

In one embodiment, tetravalent  $\text{SiO}_{4/2}$  groups (i.e., Q groups) are excluded from the branched polysiloxane composition.

In another embodiment, unsaturated hydrocarbon compounds, such as, e.g., alpha-olefins, are excluded from the component mixture from which the branched polysiloxane is derived. Some examples of such unsaturated hydrocarbon compounds include alpha-olefins of the formula  $\text{CH}_2=\text{CHR}^1$  wherein  $\text{R}^1$  is selected from halogen, hydrogen, or a heteroatom-substituted or unsubstituted hydrocarbon group having one to sixty carbon atoms. Some heteroatoms include oxygen (O) and nitrogen (N) atoms.

In yet another embodiment, oxy-substituted hydrocarbon compounds, such as oxyalkylene-containing and/or ester-containing saturated or unsaturated compounds, are excluded from the branched polysiloxane composition.

The branched polysiloxane of the antimisting component results from the copolymerization of component (a) and component (b) under hydrosilylation conditions. By "hydrosilylation conditions" is meant the conditions known in the art for hydrosilylation crosslinking between compounds containing unsaturated groups and compounds containing silylhydride groups.

As known in the art, a hydrosilylation catalyst is required to promote or effect the hydrosilylation reaction between components (a) and (b) either during or after mixing of the components at a suitable temperature. The hydrosilylation catalyst typically contains one or more platinum-group metals or metal complexes. For example, the hydrosilylation catalyst can be a metallic or complexed form of ruthenium, rhodium, palladium, osmium, iridium, or platinum. More typically, the hydrosilylation catalyst is platinum-based. The platinum-based catalyst can be, for example, platinum metal, platinum metal deposited on a carrier (e.g., silica, titania, zirconia, or carbon), chloroplatinic acid, or a platinum complex wherein platinum is complexed to a weakly binding ligand such as divinyltetramethyldisiloxane. The platinum catalyst can be included in a concentration range of, for example, 1-100 ppm, but is more typically included in a concentration of about 5 to 40 ppm.

Auxiliary and other components can be included, as necessary, in the coating formulation of the invention. Some types of auxiliary components include catalyst inhibitors (as described above), surfactants, and diluents. Some examples of diluents include the hydrocarbons (e.g., pentanes, hexanes, heptanes, octanes), aromatic hydrocarbons (e.g., benzene, toluene, and the xylenes), ketones (e.g., acetone, methylethylketone), and halogenated hydrocarbons (e.g., trichloroethylene and perchloroethylene).

In another aspect, the invention is directed to a coating process wherein the coating formulation of the invention is applied to a substrate under conditions wherein misting or aerosoling of the coating formulation is known to occur. During such mist-producing conditions, the coating formula-

tion of the invention will exhibit reduced misting as compared to the coating formulation without the anti-misting amount of branched polysiloxane.

The coating formulation can be applied, for example, by roll-coating, or alternatively, by spraying from a suitable applicator (e.g., a nozzle), wherein the applicator can be still or moving with respect to the substrate. Though misting or aerosoling is often caused predominantly by movement of the applicator with respect to a substrate, misting or aerosoling can be caused by factors other than movement of the applicator or substrate. For example, misting can be caused partially or predominantly by the method of application rather than by any motion of the applicator relative to the substrate, e.g., in a stationary or slow spraying process.

The coating process of the invention is particularly suitable for processes in which the coating formulation is being applied to a substrate in motion wherein the motion is the primary cause of the misting or aerosoling. The motion can be any kind of motion capable of causing misting or aerosoling, e.g., mist-producing levels of translational and/or rotational motion.

The substrate can be any substrate on which a coating of the above coating formulation is desired. Some examples of suitable substrates include paper, cardboard, wood products, polymer and plastic products, glass products, and metal products.

In another aspect, the invention is directed to a hardened (i.e., cured) coating obtained by hardening or curing the above coating formulation after its application on a substrate. The coating formulation, once applied to a substrate, can be cured by any suitable curing method known in the art, including, for example, hydrosilylation reaction crosslinking, peroxide curing, photocuring (e.g., UV curing), and electron beam curing.

The hardened coating can, if desired, be removed from the substrate in such cases where the coating, absent the substrate, is itself a useful product, e.g., for use as an applicable film. To aid in the separation of coating the hardened film from the substrate, a release additive can be included in the coating formulation, or a release film applied between the substrate and coating formulation.

Examples have been set forth below for the purpose of illustration. The scope of the invention is not to be in any way limited by the examples set forth herein.

#### EXAMPLE 1

##### Synthesis of Anti-Mist Component (Branched Polysiloxane)

In this example, the component referred to as Component A is a commercially available difunctional vinyl-terminated polysiloxane of the formula  $\text{M}^{\text{vi}}\text{D}_{110}\text{M}^{\text{vi}}$  having a viscosity of 200-300 cPs. The component referred to as Component B is a commercially available hexafunctional silylhydride-containing polysiloxane of the formula  $\text{M}_{500}\text{D}_{6.5}^{\text{H}}\text{M}$  having a viscosity of 6,000 to 15,000 cPs and hydride content of 155 to 180 ppm, where 6.5 represents an average number of  $\text{D}^{\text{H}}$  groups randomly incorporated amongst D groups. The component referred to as Component C is a commercially available catalyst formulation containing 10% by weight platinum.

To a 1L reactor equipped with an overhead stirrer, GN2 inlet, thermometer, and oil bath was added 168.7 g (ca. 20.2 mmol) of Component A, and ca. 0.05 g of Component C. The mixture was agitated for one hour under ambient conditions. Next, 54.4 g (ca. 1.4 mmol) of Component B was separately



## 11

cooled to 4° C. and then added to the components above with stirring. The mixture was agitated for 15 minutes under ambient conditions and then slowly heated to 90° C. After 30 minutes, some gelling was observed. To the reaction mixture was added 255.5 g of Component A at 90° C. The mixture was stirred for two hours at 90° C., cooled to room temperature (~25° C.), and discharged from the kettle. The amount of product was 430.9 g, which corresponds to a 90% yield. The shear viscosity and shear modulus were measured at 12 Hz to be 2.813 Pa·s and 201.2 Pa, respectively.

## EXAMPLE 2

### Synthesis of a Coating Formulation Containing Anti-Misting Component

A two-gallon plastic pail was charged with 94 parts (1880 g) of a commercially available  $M^{Vi}D_{110}M^{Vi}$  solution containing 100 ppm Pt and 0.4% diallylmalate inhibitor). The anti-mist additive was charged to the pail in the amount of 6 parts (120 g) and mixed with a drill-mounted agitator. The crosslinker, a commercially available hydride ( $MD_{30}D_{15}^{H}M$ ) was added to the pail in the amount of 5.5 parts (110 g). The mixture was mixed thoroughly with a drill-mounted agitator.

## EXAMPLE 3

### Synthesis of a Coating Formulation Containing Anti-Misting Component

A two-gallon plastic pail was charged with 87.8 parts (1656 g) of a commercially available  $M^{Vi}D_{100}D_{2.5}^{Vi}M^{Vi}$  solution containing 100 ppm Pt and 0.4% diallylmalate inhibitor). The anti-mist additive was charged to the pail in the amount of 6 parts (113 g) and mixed with a drill-mounted agitator. The crosslinker, a commercially available hydride ( $MD_{30}D_{15}^{H}M$ ) was added to the pail in the amount of 6.0 parts (113 g). The mixture was mixed thoroughly with a drill-mounted agitator.

## EXAMPLE 4

### Coating Process

A pilot coater was used for all coating and misting studies. The five roll coater was operated at 3,000 feet per minute. The substrate was an 18-inch wide Otis Mill UV350 paper. The coater was equipped with three-five foot air floatation gas heated dryers that were set to 550° F. Coatweight was set to ca. 0.8 lb/ream. Mist measurements were taken with a DUST-TRAK 8520 aerosol monitor manufactured by TSI Incorporated (Shoreview, Minn.) while coating paper substrate at 3,000 feet per minute. The measurements were taken above the innergate and outergate rolls at a height corresponding to the point of contact between the back-up roll and the applicator roll.

Thus, whereas there have been described what are presently believed to be the preferred embodiments of the present invention, those skilled in the art will realize that other and further embodiments can be made without departing from the spirit of the invention, and it is intended to include all such further modifications and changes as come within the true scope of the claims set forth herein.

The invention claim is:

#### 1. A composition comprising:

- (i) a silicone-based coating component susceptible to misting under mist-producing conditions; and

## 12

- (ii) an anti-misting amount of a branched polysiloxane component resulting from copolymerizing under hydrosilylation conditions a component mixture comprising:

- (a) one or more organosilicon compounds containing at least two unsaturated hydrocarbon functional groups per molecule, said unsaturated hydrocarbon functional groups capable of undergoing a hydrosilylation reaction with a silylhydride-containing compound under hydrosilylation conditions, provided that when said component (a) is a polysiloxane it contains at least one D or T silicone unit that contains at least one unsaturated hydrocarbon functional group; and

- (b) one or more silylhydride-containing compounds containing at least two silylhydride functional groups per molecule;

provided that (i) at least one component (a) or (b) contains at least three functional groups per molecule; (ii) when one component (a) or (b) has a higher number of functional groups per molecule than another component (a) or (b) having a lower number of functional groups per molecule, then the component (a) or (b) having a higher number of functional groups per molecule is present in a molar amount equal to or lower than the molar amount of the component (a) or (b) having a lower number of functional groups per molecule; and (iii) unsaturated hydrocarbon compounds are excluded from the component mixture.

2. The composition of claim 1, wherein the unsaturated hydrocarbon functional groups of component (a) are in a molar ratio to silylhydride functional groups of component (b) within a range according to a formula  $(6-s):1$  or  $1:(1+t)$  where s represents a number equal to or greater than 0 and less than 5, and t represents a number greater than 0 and equal to or less than 5.

3. The composition of claim 1, wherein the unsaturated hydrocarbon functional groups of component (a) are in a molar ratio to silylhydride functional groups of component (b) within a range according to a formula  $(4.6-s):1$  or  $1:(1+s)$  where s represents a number greater than 0 and less than 3.6.

4. The composition of claim 1, wherein the unsaturated hydrocarbon functional groups of component (a) are in a molar ratio to silylhydride functional groups of component (b) within a range according to a formula  $(4.25-s):1$  or  $1:(1+t)$  where s represents a number equal to or greater than 0 and less than 3.25, and t represents a number greater than 0 and equal to or less than 3.25.

5. The composition of claim 1, wherein the unsaturated hydrocarbon functional groups of component (a) are in a molar ratio to silylhydride functional groups of component (b) within a range according to a formula  $(4.6-s):1$  where s represents a number greater than 0 and less than 3.6.

6. The composition of claim 1, wherein the unsaturated hydrocarbon functional groups of component (a) are in a molar ratio to silylhydride functional groups of component (b) within a range of about 4.5:1 to about 2:1.

7. The composition of claim 1, wherein one component (a) or (b) has at least four functional groups per molecule and is in a lower molar amount than the other component (a) or (b) having two or three functional groups per molecule.

8. The composition of claim 1, wherein one component (a) or (b) has at least six functional groups per molecule and is in a lower molar amount than the other component (a) or (b) having two or three functional groups per molecule.

#### 9. A composition comprising:

- (i) a silicone-based coating component susceptible to misting under mist-producing conditions; and



## 13

- (ii) an anti-misting amount of a branched polysiloxane component resulting from copolymerizing under hydrosilylation conditions a component mixture comprising:
- (a) one or more organosilicon compounds containing at least two unsaturated hydrocarbon functional groups per molecule, said unsaturated hydrocarbon functional groups capable of undergoing a hydrosilylation reaction with a silylhydride-containing compound under hydrosilylation conditions, provided that when said component (a) is a polysiloxane it contains at least one D or T silicone unit that contains at least one unsaturated hydrocarbon functional group; and
- (b) one or more silylhydride-containing compounds containing at least two silylhydride functional groups per molecule;
- provided that (i) at least one component (a) or (b) contains at least three functional groups per molecule; (ii) one component (a) or (b) has a higher number of functional groups per molecule and is in a lower molar amount than another component (a) or (b) having a lower number of functional groups per molecule; and (iii) unsaturated hydrocarbon compounds are excluded from the component mixture.
- 10.** A composition comprising:
- (i) a silicone-based coating component susceptible to misting under mist-producing conditions; and
- (ii) an anti-misting amount of a branched polysiloxane component resulting from copolymerizing under hydrosilylation conditions a component mixture comprising:
- (a) one or more organosilicon compounds containing at least two unsaturated hydrocarbon functional groups per molecule, said unsaturated hydrocarbon functional groups capable of undergoing a hydrosilylation reaction with a silylhydride-containing compound under hydrosilylation conditions, provided that when said component (a) is a polysiloxane it contains at least one D or T silicone unit that contains at least one unsaturated hydrocarbon functional group; and
- (b) one or more silylhydride-containing compounds containing at least two silylhydride functional groups per molecule;
- provided that (i) at least one component (a) or (b) contains at least three functional groups per molecule; (ii) unsaturated hydrocarbon functional groups of component (a) are in a molar ratio to silylhydride functional groups of component (b) within a range of about  $(6-s):1$  or about  $1:(1+t)$  where  $s$  represents a number equal to or greater than 0 and less than 5, and  $t$  represents a number greater than 0 and equal to or less than 5; (iii) one component (a) or (b) has a higher number of functional groups per molecule and is in a lower molar amount than another component (a) or (b) having a lower number of functional groups per molecule; (iv) unsaturated hydrocarbon compounds are excluded from the component mixture.
- 11.** A composition comprising:
- (i) a silicone-based coating component susceptible to misting under mist-producing conditions; and
- (ii) an anti-misting amount of a branched polysiloxane component resulting from copolymerizing under hydrosilylation conditions a component mixture comprising:
- (a) one or more organosilicon compounds containing at least two unsaturated hydrocarbon functional groups per molecule, said unsaturated hydrocarbon functional

## 14

- groups capable of undergoing a hydrosilylation reaction with a silylhydride-containing compound under hydrosilylation conditions, provided that when said component (a) is a polysiloxane it contains at least one D or T silicone unit that contains at least one unsaturated hydrocarbon functional group; and
- (b) one or more silylhydride-containing compounds containing at least two silylhydride functional groups per molecule;
- provided that (i) at least one component (a) or (b) contains at least three functional groups per molecule; (ii) unsaturated hydrocarbon functional groups of component (a) are in a molar ratio to silylhydride functional groups of component (b) within a range according to a formula  $(4.6-s):1$  or  $1:(1+s)$  where  $s$  represents a number greater than 0 and less than 3.6; (iii) one component (a) or (b) has a higher number of functional groups per molecule and is in a lower molar amount than another component (a) or (b) having a lower number of functional groups per molecule; (iv) unsaturated hydrocarbon compounds are excluded from the component mixture.
- 12.** A composition comprising:
- (i) a silicone-based coating component susceptible to misting under mist-producing conditions; and
- (ii) an anti-misting amount of a branched polysiloxane component resulting from copolymerizing under hydrosilylation conditions a component mixture comprising:
- (a) one or more organosilicon compounds containing unsaturated hydrocarbon functional groups, said unsaturated hydrocarbon functional groups capable of undergoing a hydrosilylation reaction with a silylhydride-containing compound under hydrosilylation conditions, provided that when said component (a) is a polysiloxane it contains at least one D or T silicone unit that contains at least one unsaturated hydrocarbon functional group; and
- (b) one or more silylhydride-containing compounds containing silylhydride functional groups;
- provided that (i) one component (a) or (b) has at least four functional groups per molecule and is in a lower molar amount than another component (a) or (b) having two or three functional groups per molecule; (ii) unsaturated hydrocarbon functional groups of component (a) are in a molar ratio to silylhydride functional groups of component (b) within a range of about  $(6-s):1$  or about  $1:(1+t)$  where  $s$  represents a number equal to or greater than 0 and less than 5, and  $t$  represents a number greater than 0 and equal to or less than 5; and (iii) unsaturated hydrocarbon compounds are excluded from the component mixture.
- 13.** A composition comprising:
- (i) a silicone-based coating component susceptible to misting under mist-producing conditions; and
- (ii) an anti-misting amount of a branched polysiloxane component resulting from copolymerizing under hydrosilylation conditions a component mixture comprising:
- (a) one or more organosilicon compounds containing unsaturated hydrocarbon functional groups, said unsaturated hydrocarbon functional groups capable of undergoing a hydrosilylation reaction with a silylhydride-containing compound under hydrosilylation conditions, provided that when said component (a) is a polysiloxane it contains at least one D or T silicone unit that contains at least one unsaturated hydrocarbon functional group; and



15

(b) one or more silylhydride-containing compounds containing silylhydride functional groups; provided that (i) one component (a) or (b) has at least six functional groups per molecule and is in a lower molar amount than another component (a) or (b) having two or three functional groups per molecule; (ii) unsaturated hydrocarbon functional groups of component (a) are in a molar ratio to silylhydride functional groups of component (b) within a range of about  $(6-s):1$  or about  $1:(1+t)$  where  $s$  represents a number equal to or greater than 0 and less than 5, and  $t$  represents a number greater than 0 and equal to or less than 5; and (iii) unsaturated hydrocarbon compounds are excluded from the component mixture.

14. A coating process comprising applying to a substrate under mist-producing conditions the composition of claim 1, the composition exhibiting reduced misting when subjected to said mist-producing conditions as compared to the same composition lacking an anti-misting amount of branched polysiloxane component.

15. A coating process comprising applying to a substrate under mist-producing conditions the composition of claim 2, the composition exhibiting reduced misting when subjected to said mist-producing conditions as compared to the same composition lacking an anti-misting amount of branched polysiloxane component.

16. A coating process comprising applying to a substrate under mist-producing conditions the composition of claim 3, the composition exhibiting reduced misting when subjected to said mist-producing conditions as compared to the same composition lacking an anti-misting amount of branched polysiloxane component.

17. A coating process comprising applying to a substrate under mist-producing conditions the composition of claim 4, the composition exhibiting reduced misting when subjected to said mist-producing conditions as compared to the same composition lacking an anti-misting amount of branched polysiloxane component.

18. A coating process comprising applying to a substrate under mist-producing conditions the composition of claim 5, the composition exhibiting reduced misting when subjected to said mist-producing conditions as compared to the same composition lacking an anti-misting amount of branched polysiloxane component.

19. A coating process comprising applying to a substrate under mist-producing conditions the composition of claim 6, the composition exhibiting reduced misting when subjected to said mist-producing conditions as compared to the same composition lacking an anti-misting amount of branched polysiloxane component.

20. A coating process comprising applying to a substrate under mist-producing conditions the composition of claim 7, the composition exhibiting reduced misting when subjected to said mist-producing conditions as compared to the same composition lacking an anti-misting amount of branched polysiloxane component.

21. A coating process comprising applying to a substrate under mist-producing conditions the composition of claim 8, the composition exhibiting reduced misting when subjected to said mist-producing conditions as compared to the same composition lacking an anti-misting amount of branched polysiloxane component.

22. A coating process comprising applying to a substrate under mist-producing conditions the composition of claim 9, the composition exhibiting reduced misting when subjected

16

to said mist-producing conditions as compared to the same composition lacking an anti-misting amount of branched polysiloxane component.

23. A coating process comprising applying to a substrate under mist-producing conditions the composition of claim 10, the composition exhibiting reduced misting when subjected to said mist-producing conditions as compared to the same composition lacking an anti-misting amount of branched polysiloxane component.

24. A coating process comprising applying to a substrate under mist-producing conditions the composition of claim 11, the composition exhibiting reduced misting when subjected to said mist-producing conditions as compared to the same composition lacking an anti-misting amount of branched polysiloxane component.

25. A coating process comprising applying to a substrate under mist-producing conditions the composition of claim 12, the composition exhibiting reduced misting when subjected to said mist-producing conditions as compared to the same composition lacking an anti-misting amount of branched polysiloxane component.

26. A coating process comprising applying to a substrate under mist-producing conditions the composition of claim 13, the composition exhibiting reduced misting when subjected to said mist-producing conditions as compared to the same composition lacking an anti-misting amount of branched polysiloxane component.

27. A hardened silicone-based coating or film produced by subjecting a substrate coated with the composition of claim 1 to one or more curing steps.

28. A hardened silicone-based coating or film produced by subjecting a substrate coated with the composition of claim 10 to one or more curing steps.

29. A composition comprising:

(i) a silicone-based coating component susceptible to misting under mist-producing conditions; and

(ii) an anti-misting amount of a branched polysiloxane component resulting from copolymerizing under hydrosilylation conditions a component mixture comprising:

(a) one or more organosilicon compounds containing at least two unsaturated hydrocarbon functional groups per molecule, said unsaturated hydrocarbon functional groups capable of undergoing a hydrosilylation reaction with a silylhydride-containing compound under hydrosilylation conditions, provided that when component (a) is a polysiloxane it contains at least three unsaturated hydrocarbon functional groups per molecule; and  
(b) one or more silylhydride-containing compounds containing at least two silylhydride functional groups per molecule;

provided that (i) at least one component (a) or (b) contains at least three functional groups per molecule; (ii) when one component (a) or (b) has a higher number of functional groups per molecule than another component (a) or (b) having a lower number of functional groups per molecule, then the component (a) or (b) having a higher number of functional groups per molecule is present in a molar amount equal to or lower than the molar amount of the component (a) or (b) having a lower number of functional groups per molecule; and (iii) unsaturated hydrocarbon compounds are excluded from the component mixture.